Dr. Lewis Teperman

One Foot in Heaven

ON APRIL 23, 2009, Dariusz Reszuta awoke in the 17th-floor ICU of NYU Langone Medical Center's Tisch Hospital to the news that his liver transplant had gone perfectly. Normally, such a report would elicit a sigh of relief, if not a celebratory cheer. Instead, Reszuta, a 33-year-old commercial plumber from Queens, was dumbfounded. "I didn't know what was going on," he says. "I didn't even remember being sick. The last thing I could recall was that I was out shopping with my son."

As the fog of a week-long coma slowly lifted, Reszuta learned that in mid-April, his liver had started to fail for no apparent reason. A few days later, he was brought to NYU Langone's Emergency Department, unconscious. Toxins that the liver normally clears from the blood had begun accumulating in his body, turning his eyes and skin a sickly yellow and causing his brain to swell. He didn't have long—at most a day or two, more likely just hours—until irreversible brain damage set in and his other vital organs failed.

Reszuta, who emigrated to the United States from Poland in the 1990s, was immediately moved to the top of the regional transplant waiting list. "But there wasn't a single donor organ available in the whole country," says his surgeon, Lewis Teperman, MD, vice chair of surgery and director of transplantation at NYU Langone. To buy time, the transplant team pumped the patient with the first of 24 units of blood plasma, in an effort to dilute the life-threatening toxins.

This was only a temporary stopgap, however. The patient's one remaining hope for survival was an experimental bio-artificial liver, a blood-pumping machine packed with human liver cells that had just been approved by the FDA for a nationwide clinical trial. The device—the Extracorporeal Liver-Assist Device, or ELAD, manufactured by Vital Therapies, Inc., of San Diego—would take over for his liver, much like a dialysis machine does for failing kidneys, until a suitable donor organ could be found.

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There were significant obstacles to using the ELAD, however. "This device had been used in several preliminary clinical trials but never with a patient who was so sick and about to die," Dr. Teperman explains. What's more, the liver cells were in storage in California, the machinery was still in Massachusetts, and the only technicians trained in its use were in Michigan. Finally, the device's trial hadn't yet been approved by NYU's Institutional Review Board (IRB), an independent committee that reviews all clinical trials to ensure that the rights and welfare of patients are protected.

Undaunted, Dr. Teperman and the Reszuta family pressed forward, setting in motion a frenzied scramble to win emergency IRB approval and fly in the necessary parts and personnel. Amazingly, in less than 24 hours, everything was in place.

At 5:15 p.m. on April 22, Reszuta was brought to the operating room, where

PHOTOGRAPH BY
WESLEY MANN

a tube was inserted into his jugular, diverting his blood into the ELAD. Inside the device, his blood plasma was separated out and passed through four filter cartridges containing about 15 ounces of human liver cells (one-quarter the weight of an intact liver), cleansing his blood of toxins and synthesizing life-sustaining proteins. After passing through these filters, the blood was reinfused, streaming continuously from patient to machine and back again.

The secret to the ELAD is the liver cells. Far from ordinary, the cells are derived from a liver tumor taken from an adolescent boy 20 years ago. While normal liver cells die outside of the body in a matter of hours, these cells are essentially immortal. They can be continuously replicated in bioreactors at Vital Therapies' lab and packed in dry ice for up to 48 hours for shipment to hospitals.

An important safety feature of the ELAD is that the patient's blood never comes into direct contact with the immortalized cells. Instead, the blood flows through semipermeable hollow fibers in the cartridges that allow toxins and proteins to be exchanged with the liver cells. Within hours, Reszuta's blood levels of ammonia and lactic acid began to drop. "We knew the machine was working," says Dr. Teperman. "But because he had deteriorated so much, we didn't know if he had already suffered permanent brain damage."

A Bio-Artificial Liver

Canisters packed with human liver cells act much like a human dialysis machine, enabling patients to survive until a human donor can be found.

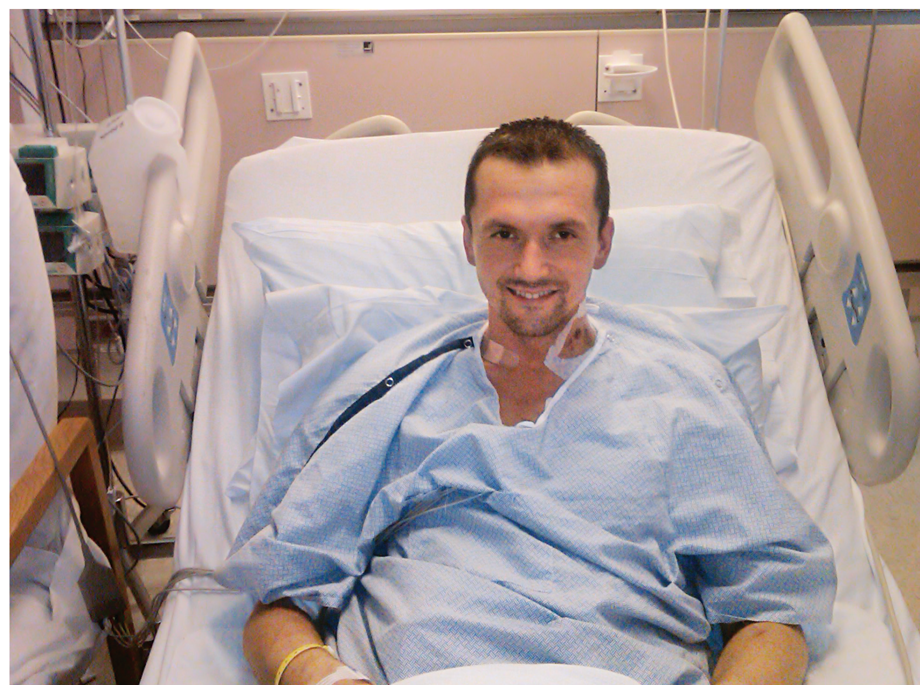
In the meantime, a donor organ became available in Tennessee and arrangements were made to fly it to JFK airport. Bad weather delayed the flight, adding more tension to an already tense situation, but finally the liver arrived in New York. Eight hours later, Dr. Teperman and his team performed the transplant and turned off the ELAD.

"Would he have survived without it?" Dr. Teperman wonders aloud. "I can't tell. But I do know that he had one foot in heaven. A month and a half ago, we transplanted someone who was just as ill. He survived the operation, but his brain didn't. There's such a critical organ shortage in this country. About 2,000 patients die each year waiting for a liver. So having a bridge is a wonderful idea—if we can prove that ELAD works."

Dr. Teperman never did figure out what caused Reszuta's liver to fail, which happens in about a quarter of all acute liver failure cases, though he was able to rule out all known viruses and Tylenol poisoning, the most common culprits. Nonetheless, Reszuta made a full recovery. He will have to take immunosuppressant medications for life to prevent his body from rejecting the new liver, but he isn't complaining. Sitting in Dr. Teperman's office one month after his brush with death, Reszuta is all smiles—thankful for the opportunity to spend precious time with his son and family and perhaps pursue a new career in information technology. "I'm lucky I chose the right hospital," he says. ●

—GARY GOLDENBERG

After being close to death, Dariusz Reszuta survived thanks to an experimental device and a liver transplant.



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